Forest Pest Management
Pacific Northwest Region

FOREST PEST EVALUATION

SNOWKING SALE AREA

MT. ADAMS RANGER DISTRICT

GIFFORD PINCHOT NATIONAL FOREST

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12/27/84
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Forest Pest Survey
Snowking Sale Area
Mount Adams Ranger District
Gifford Pinchot National Forest, Washington

by

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Introduction

During portions of August and September 1984, Forest Pest Management personnel did a forest pest survey within the proposed Snowking Sale Area (T. 7 N., R. 10 E., secs. 24, 25, 26, 35, and 36, and T. 7 N., R. 11 E., secs. 29, 31, 32, and 33). The areas examined include two separate blocks, the Clem subdivision to the west and the Snowking subdivision to the east (Figure 1). Purposes of the evaluation were to determine causes and amount of pest losses, identify and map problem areas, and develop management recommendations aimed at minimizing current and future losses. This information was requested by the District for use in developing pre-sale plans and aiding prescription formulations.

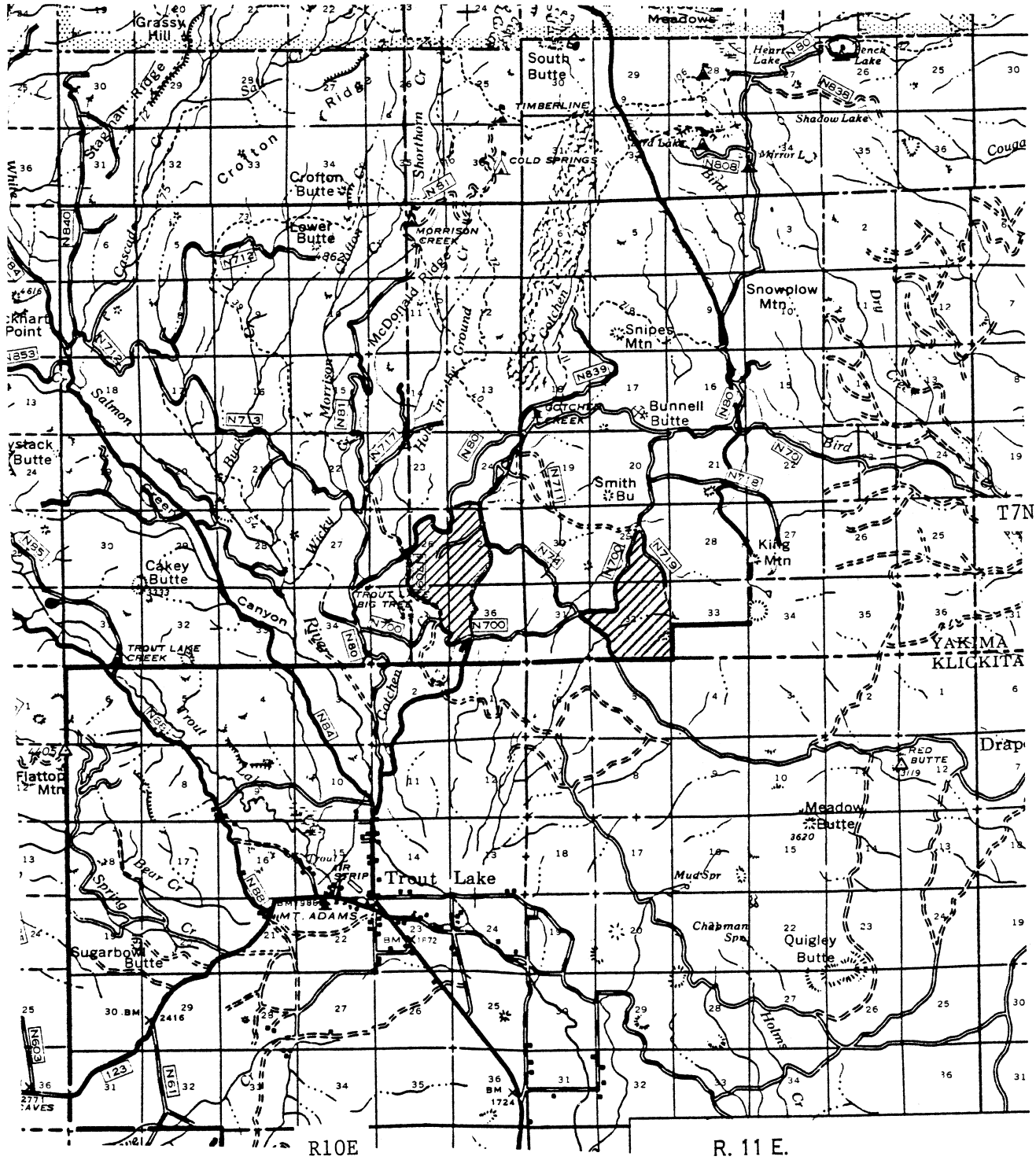
Site and Stand Characteristics

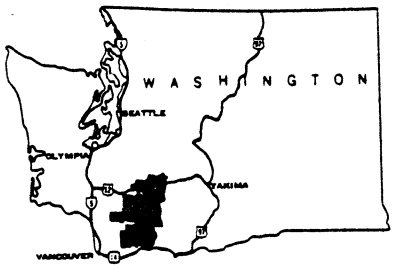
Clem Block

Site quality in this area is moderate. Topography is predominantly gentle with some moderate to steep slopes on the west side of the survey unit. Aspect is mostly west, southwest, and south. Light soils of volcanic origin predominate throughout the area. In exposed sites, desiccation in the summer is an apparent problem. Elevation ranges from 2600 to 3400 feet. The survey area is shown in Figure 2.

Two distinct stand types are found in this block. The southern third of the unit and west-facing breaks on the west side of the area are predominantly a ponderosa pine and Douglas-fir mix. These species make up most of the overstory and understory. Grand fir and western larch are minor stand components. Early railroad logging had removed an overstory which was mostly large diameter pine with fewer Douglas-firs. The remainder of the survey unit is currently adequately stocked with all-aged grand fir. An overstory of ponderosa pine and Douglas-fir was partially removed during early railroad logging. Mostly pine, Douglas-fir, and grand fir were removed in subsequent entries.

Size classes represented include small and large sawlogs. Sapling- to pole-sized advanced regeneration is common as a result of the stands being opened. Several young plantations are present. These are all clearcut units planted mostly to ponderosa pine.





Gifford Pinchot National Forest

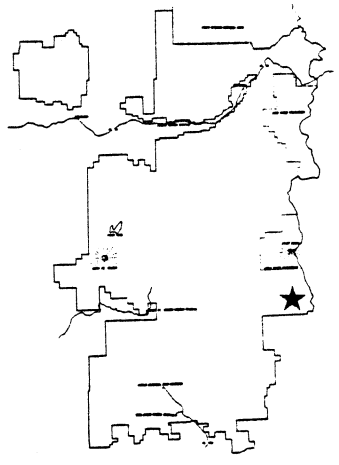


Figure 1. Map depicting location (crosshatching) of the survey area, Mt. Adams Ranger District, Gifford Pinchot National Forest.

As mentioned, these stands were first entered during the early 1900's and logged of what was a predominantly old-growth ponderosa pine, Douglas-fir, and grand fir stand. At least two subsequent entries were evident. These included partial cuts over most of the area and several clearcuts. Some small group selection cuts may have been used to harvest dead and dying timber. The northernmost portion of the block was logged very recently. This area was not surveyed.

Snowking Block

Site quality in this block is moderate. Topography is very gentle throughout the entire survey area. Aspect is almost all southwest. Light volcanic soils are also present in this area. Elevation ranges from 3200 to 3850 feet. The survey area is shown in Figure 3.

Stands within this block are fairly uniform. Prior to early logging, ponderosa pine was a major stand component. Currently, pine is most common towards the southern portion of the survey block. Grand fir and a lesser amount of Douglas-fir now make up most of the stocking in the area. Engelmann spruce and lodgepole pine are minor species.

Size classes are an even mix between small and large sawlogs. Advanced regeneration is scattered. This is probably because most of the basal area had been removed in partial cutting done in recent years. Several clearcuts have been planted to ponderosa and lodgepole pine.

Methods

Transects were run at 5-chain (330 ft.) intervals across the Clem block and 10-chain (660 ft.) intervals across the Snowking block. The survey areas were scrutinized at 100 percent coverage for the Clem block and 50 to 60 percent coverage for the Snowking unit. This was done by reconnoitering a $2\frac{1}{2}$- to 3-chain wide strip on either side of the transect. Difference in sampling intensity between the two blocks was because of District priorities and time constraints. Root disease centers were mapped with boundaries based on the furthermost extent of dead or symptomatic trees. In the Snowking block, attempts were made to approximate closely the extent of root disease centers that extended beyond the regularly reconnoitered strip between transects. This information was used to make composite maps of both areas (Figures 2 and 3).

Approximately 550 acres in the Clem block and 610 acres in the Snowking block were surveyed systematically using a variable radius plot method. In the Clem block, plots were placed at 5-chain intervals along transects and a basal area factor (BAF) of 40 was used. In the Snowking block, plots were placed at 10-chain intervals and a BAF of 20 was used.

Each plot was examined for evidence of disease or insect infestation. This included dead and dying trees, old stubs and stumps, and less than normal stocking. Dead trees and trees exhibiting symptoms of root diseases were

examined to determine the causal pest(s). This involved (a) removing a section of bark from the boles of dead trees to check for bark beetles or their galleries, and (b) removing a section of bark on one or more sides of the root collar and exposing and dissecting portions of two or more large roots to check for stained wood or mycelia of root disease fungi. In plots containing root disease or insect infestation, the following data were collected for each affected tree on the plot: tree species, DBH, general condition (live, dead, standing, down), and presence of insects and diseases. A basal area count was made for all apparently healthy trees on the plot by species. For every fifth plot in the Clem block and every tenth plot in the Snowking block, similar data were collected for all plot trees. From this information, mean basal area and number of trees per acre by tree species, DBH class, condition, and pests were calculated.

Results and Discussion

Clem Block

Mean basal areas and number of trees per acre are shown in Table 1. Most mortality was due to root rot, especially Armillaria root rot, caused by *Armillaria mellea*. Annosus root rot, caused by *Fomes annosus*, resulted in some damage to grand fir. Girdling, caused by black bear, also has resulted in scattered mortality. Values given for live, disease-infected trees are definite underestimates because of difficulty in detection on trees not yet showing crown symptoms. Trees and basal area per acre by condition and diameter class are shown in Table 2.

Locations of root disease centers are shown in Figure 2. Armillaria root rot was the most frequently encountered mortality-causing disease throughout the survey area. Armillaria root rot was detected on at least one tree on 14.4 percent of the plots. Total average basal area of living trees for all healthy plots was 151.9 ft^2. Total average basal area of living trees on plots with at least one dead or dying tree with root disease was 140.9 ft^2 or 92.8 percent that of healthy plots.

Armillaria root rot was found in both stand types in the survey block. However, the severity and apparent virulence of the fungus seemed different. It may be possible that more than one strain of *A. mellea* is present. In the stands with a large pine component, Armillaria root rot appeared fairly virulent. Active pine mortality was occurring, with smaller sapling and pole-sized trees being most severely affected. Most of the source of infection was the old remnant pine stumps.

Throughout portions of grand fir-dominated stands, Armillaria root rot was also present; however, source of infection and damage appeared different. Infection and mortality seemed associated with recent cutting. Most disease was found adjacent to or had spread from edges of clearcuts, roads, and skid trails and around old landings and burn piles. Individual trees which became infected usually were not very vigorous specimens. Throughout the block, species susceptibility was as follows: grand fir > ponderosa pine > Douglas-fir > western larch.

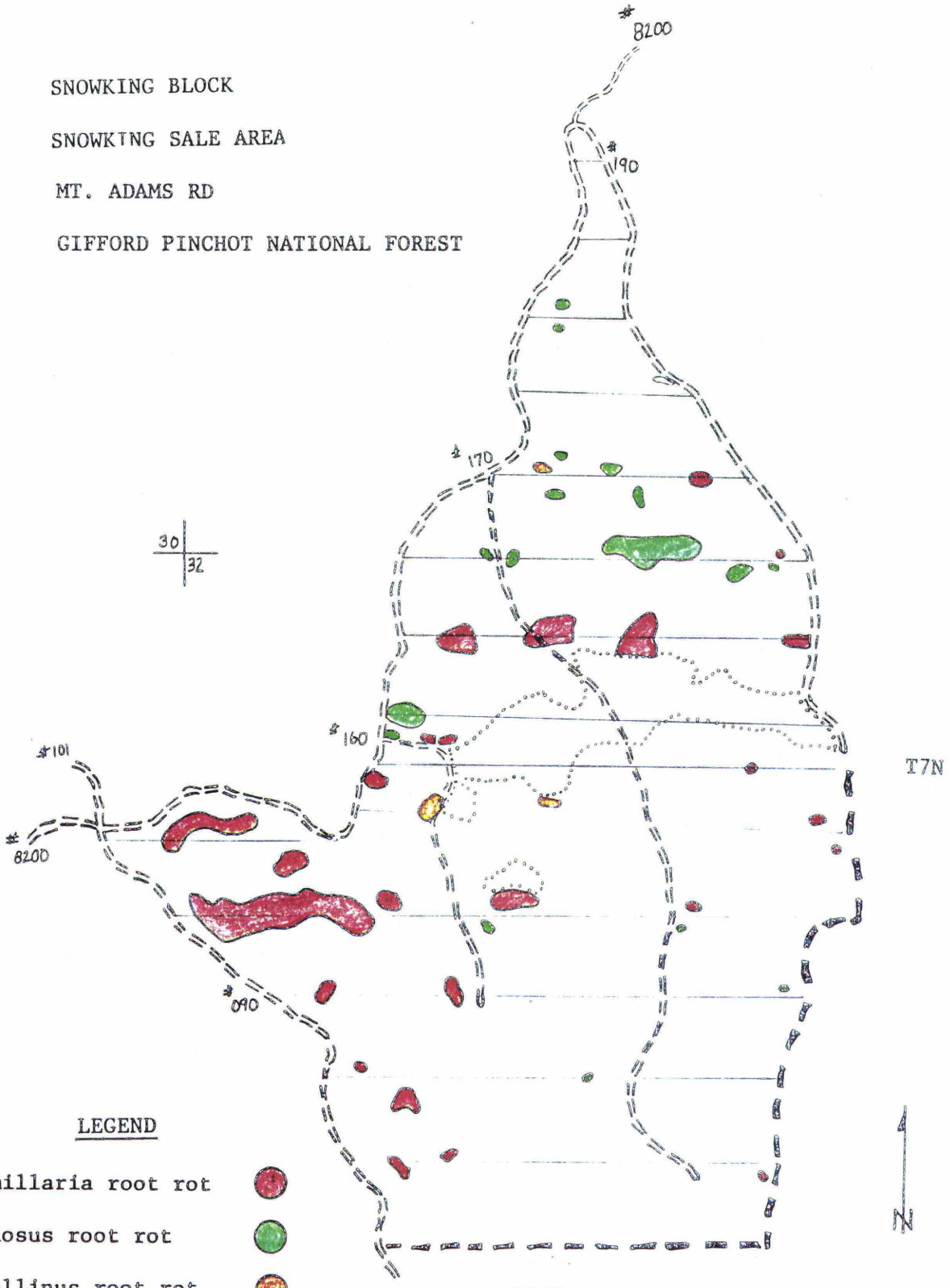
LOCATION OF ROOT DISEASES

SNOWKING BLOCK

SNOWKING SALE AREA

MT. ADAMS RD

GIFFORD PINCHOT NATIONAL FOREST



LEGEND

Armillaria root rot

Annosus root rot

Phellinus root rot

Plantation boundary

Survey boundary

Survey transect

CLS/10/84

Figure 1

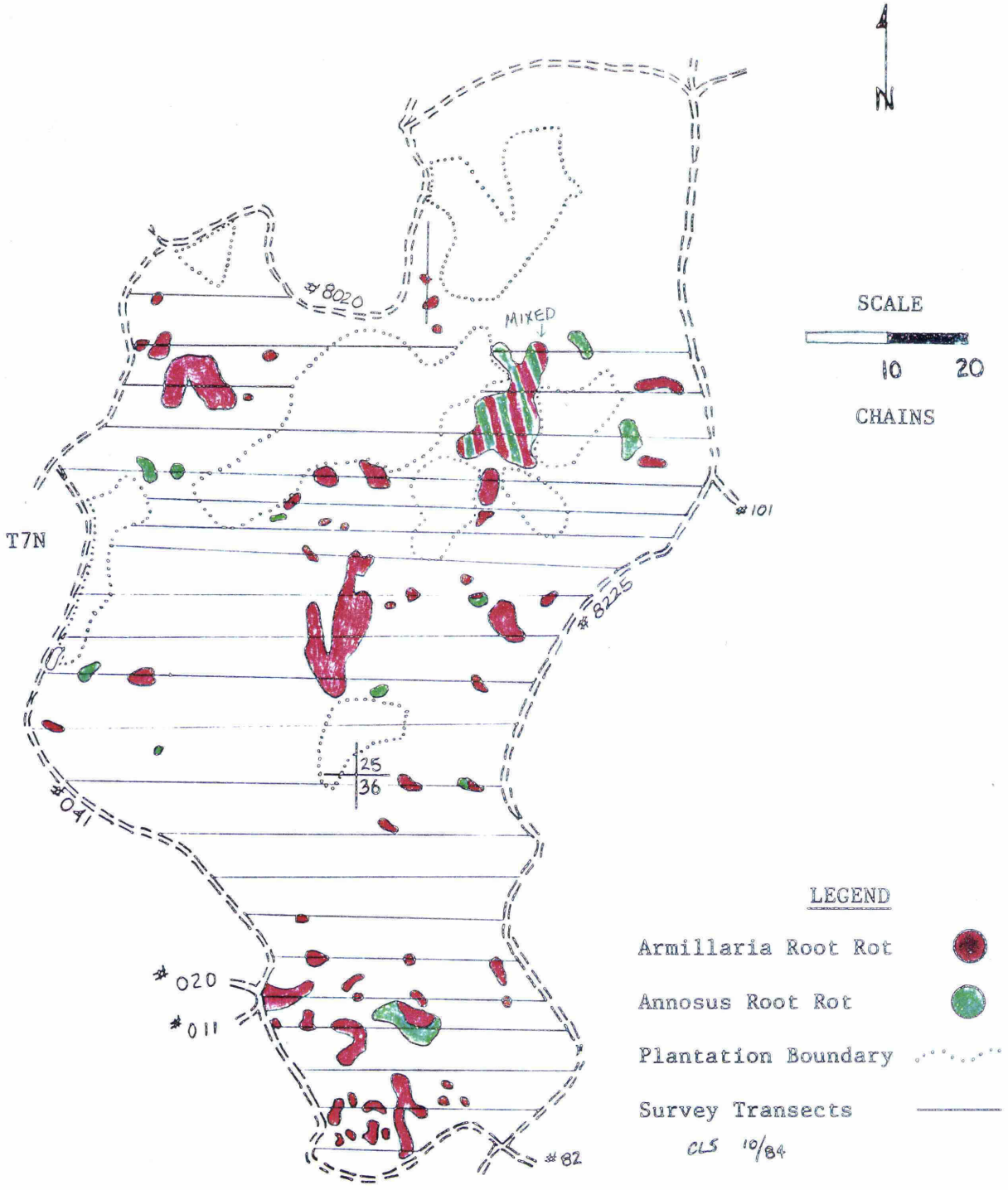
LOCATION OF ROOT DISEASES

CLEM BLOCK

SNOWKING SALE AREA

MT. ADAMS RD

GIFFORD PINCHOT NATIONAL FOREST



R10E

Figure 2

A minor amount of Armillaria root rot was found in young pine plantations within the survey block. It appeared as scattered single tree mortality mainly associated with factors other than old disease centers. Incidence of mortality may continue for 5 to 10 years as damaged or poorly planted trees become infected.

Annosus root rot was identified as being associated with Armillaria root rot-caused mortality in some cases. Its role in causing mortality in these true fir stands may be underestimated because it is hard to detect when associated with other root rots. Annosus root rot was almost always associated with wounding or trees near large, old, grand fir stumps. F. annosus fruiting bodies could often be found in these decaying stumps (Plate 1). Only grand fir trees were found being infected by F. annosus. Two ponderosa pine stumps were found that contained conks; however, no nearby mortality was found that resulted from these infected stumps.

Dwarf mistletoes were found in several species during the survey. The most widely infected species was grand fir which was being affected by true fir dwarf mistletoe, Arceuthobium abietinum. Infections of Cytospora canker, caused by Cytospora abietis, were often found associated with grand fir dwarf mistletoe. Branch flagging is a very visible symptom of infection (Plate 2).

Douglas-fir dwarf mistletoe (A. douglasii) was found in a few small, widely scattered groups of larger trees. One very large, severely infected Douglas-fir had recently been killed by this parasite. Other dwarf mistletoes found during the survey were western larch dwarf mistletoe (A. laricis) and a very small amount of western pine dwarf mistletoe (A. campylopodum), found on ponderosa pine. No attempts were made to map or quantify dwarf mistletoe during this survey.

The fir engraver (Scolytus ventralis) was commonly found associated with dead and dying grand fir with root rot.

Snowking Block

Mean basal areas and number of trees per acre are shown in Table 3. Ponderosa pine mortality identified on plots was limited to one tree attacked by mountain pine beetles (Dendroctonus ponderosae) and having Armillaria root rot. Grand fir mortality was chiefly due to root diseases. Three different root diseases were identified. These were Armillaria root rot, annosus root rot, and laminated root rot caused by Phellinus weirii. Storm-caused windthrow and black bear girdling also caused significant losses. Trees and basal area per acre by condition and diameter class are shown in Table 4.

Armillaria root rot was the most serious disease-causing agent encountered in the survey. It was causing substantial losses in the southwestern portion of the block where most of the pine is present. Species susceptibility was as follows: grand fir > ponderosa pine > Douglas-fir.

Armillaria root rot was detected on at least one tree on 13.8 percent of the plots. Locations of root disease centers are shown in Figure 3.

Most Armillaria root rot-caused mortality was fairly scattered. Even most centers indicated in Figure 3 contain numerous, apparently healthy trees. In the southwest portion of the survey block, ponderosa pine is more common. Armillaria root rot is most severe in these stands, and pine and grand fir are the preferred hosts. As in the Clem block, but not as pronounced, Armillaria root rot appeared to become less aggressive as we moved eastward to a heavier grand fir component. In these areas, Armillaria root rot seemed to be found in disturbed areas, associated with wounds and disturbance rather than large old stumps.

Annosus root rot was also frequently found in stands stocked with predominantly true fir. Numerous large, old grand fir stumps are present, resulting from an entry(ies) 25 plus years ago. Most F. annosus infection and mortality were centered around single stumps or groups of these stumps. Wounding in past entries was also associated with much of the F. annosus infection in grand fir.

Laminated root rot was found in three small centers in this block. Grand firs and Douglas-fir were being killed. Most damage was observed as windthrow of trees predisposed by root rot.

Plate 1.
Fomes annosus fruiting bodies (conks) in an old grand fir stump.

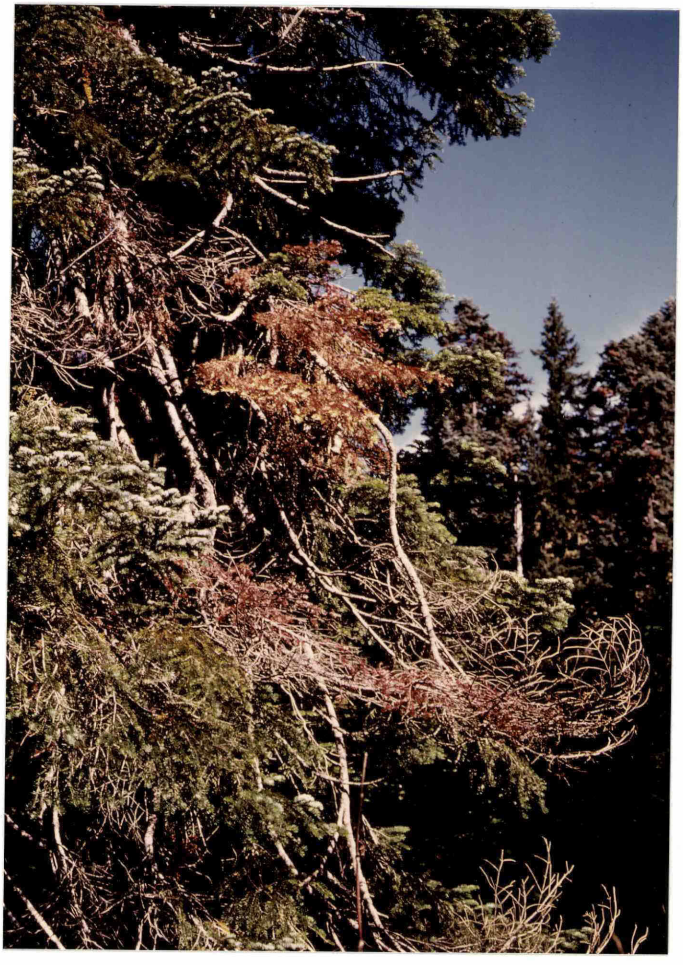


Plate 2. Branch flagging on grand fir caused by Cytospora canker/ dwarf mistletoe complex.

Plate 3. Rhizomorphs of Armillaria mellea. These shoestring-like structures are the principal mechanism for spread of Armillaria root rot.

Plate 4. Mycelial fans of A. mellea. These very characteristic and diagnostic structures are found under the bark at the root collar of live infected and recently killed host trees.

Plate 5. Red-brown stain caused by Fomes annosus on grand fir. Note the uneven margin of the stain.

Disease Biology and Identification

Armillaria root rot

Armillaria root rot is found throughout the Northwest on a variety of hosts. In eastern Washington and Oregon, this disease is frequently encountered in mixed conifer stands at endemic levels. In some areas, damage becomes severe. Reasons for this are varied. Apparently several strains, subspecies, or even species of what is called A. mellea occur in our region. Different appearance, relative pathogenicity, and species preference of the fungus are reasons for this hypothesis.

Site differences are another factor influencing disease severity. In stands that have been partially cut, stumps can serve as reservoirs of infective inoculum. The fungus may remain viable in these stumps for up to 50 years.

Tree wounding, soil compaction, and other site disturbances that tend to weaken tree vigor can cause an increase in Armillaria root rot. Stressed young trees are especially susceptible to infection and mortality.

Variability among tree species to infection sometimes is observed in different areas. In most cases, younger age classes within species are more susceptible to mortality. In stands where a large stand component is susceptible to infection, coupled with other factors increasing site hazard or tree susceptibility, Armillaria root disease can cause severe losses.

Armillaria root rot can cause single tree death but, more often, mortality occurs in groups of trees, usually centered around a source of infection such as a stump or wounded tree(s).

One method of disease spread is via root contacts or grafts between healthy trees and those of infected stumps. A more important mechanism of spread is by fungal structures called rhizomorphs (Plate 3). These are black, string-like growths that grow through the soil for up to 6 feet from large pieces of inoculum such as root systems of stumps. Rhizomorphs can sometimes be found under the bark around the root collar of A. mellea-killed trees between 2 and 5 years following death. They may also be found growing along or around the surface of infected roots. They are easily recognized by breaking them open, exposing the white-to cream-colored interior which is a striking contrast to the
black exterior.

Crown symptoms caused by Armillaria root rot often include chlorotic foliage and/or a distress cone crop. Resinosis around the base of the bole is very common. Cream-colored mycelial fans are often found growing under the bark at the root collar and roots of infected trees (Plate 4). For a few weeks in the fall, the A. mellea mushrooms may be found growing at the base of infected or recently killed trees and stumps.

Annosus Root Rot

Annosus root rot causes decay and mortality in several Northwest timber species. In eastern Washington and Oregon, true firs are the most susceptible and damaged hosts.

Fomes annosus spreads long distances via windborne spores. Conks, which commonly occur in the interior of older true fir stumps or stubs, produce immense numbers of these spores. Spores that land on fresh wounds or freshly cut stumps surfaces of true fir may germinate and the fungus may then eventually colonize the tree or stump. Local spread is similar to that described for Armillaria root rot in that the fungus grows across root contacts and grafts. Average annual rate of spread is about 1 foot.

Infection results in tree decline, growth reduction, crown thinning and, eventually death. Fir engraver beetles will frequently attack trees with advanced root rot, hastening tree death.

Annosus root rot can be recognized by irregular, reddish-brown stain in the infected roots (Plate 5). Proximity to old fir stumps and "root-balls" of dead and down trees will aid in confirmation. Advanced decay caused by F. annosus on true fir is typically laminated with small, oval pits (1 x 2 mm) on one side of separating sheets of decayed wood.

Fomes annosus attacks other tree species such as Douglas-fir and ponderosa pine less frequently than true firs. However, evidence suggests that the strain of F. annosus that attacks these species is different from that which affects grand fir. Crossover or disease spread between different tree species generally is not common and was not observed in this survey.

Laminated Root Rot

Laminated root rot, caused by Phellinus weirii, is the most serious root disease found in Northwest forests. It is commonly found in East Side mixed conifer stands with a large component of disease-susceptible species. A definite difference exists in tree species susceptibility. Most susceptible species include grand fir and Douglas-fir; intermediately susceptible, western larch and Engelmann spruce; tolerant, lodgepole pine; resistant, ponderosa pine; immune, hardwoods.

P. weirii can survive as a saprophyte for many years on dead host material (large roots and stumps). New infections occur when roots of healthy susceptible trees contact this material. Centers develop when the pathogen grows from diseased trees and infects healthy trees via root contacts or grafts. Laminated root rot can thus remain on the site, infecting subsequent generations.

Disease centers expand as more trees become infected. The rate of expansion can be as much as 1 to 2 feet per year. Stands stocked by less susceptible species may slow the rate of expansion.

Laminated root rot can be identified from a variety of signs and symptoms. The disease usually causes patches or groups of dead and dying trees in pole-sized or larger stands. Infected trees exhibit crown symptoms, including reduced height growth, and thinning and chlorotic foliage. Trees will usually be severely infected before crown symptoms are apparent. Such trees are prone to windthrow. Disease patches usually will appear as pockets of dead and down trees, with infected trees exhibiting crown symptoms at the perifery.

Diseased windthrown trees will frequently have "root-balls;" remnants of the root systems that were decayed and broken off just below the root collar. Exposed decayed wood will usually delaminate along the annual rings and exhibit growth of reddish-brown setal hyphae, and pitting on both sides of delaminated sheets. Pits are ovoid and small, measuring about 1 x 2 mm. Living-diseased or recently-killed trees will often have whitish, crusty, ectotrophic mycelia of the fungus growing on the surface of infected roots. On larger roots of older trees, this mycelium can usually be found in bark crevices.

Dwarf Mistletoes

Dwarf mistletoes are plant parasites that seriously affect most Northwest conifers. There are a number of species of dwarf mistletoes. Each is rather species-specific as to the hosts they affect. While some crossover does occur, it is not at a high enough level to warrant management concern. An exception to this is the susceptibility of lodgepole pine to western larch dwarf mistletoe (A. laricis).

Dwarf mistletoes are generally similar in their life cycles, mode of spread, and infection. Host damage usually includes formation of "witches'-brooms" and growth loss. Some hosts such as Douglas-fir and western larch are often killed following years of severe infection. Infected Douglas-firs are also often severely deformed, especially if they become infected when they are young. Infected western larch will usually have much smaller crowns than similar, uninfected trees.

Grand fir will commonly be severely infected before decline is obvious. Branch flagging and dying is common in some localities as a result of Cytospora canker infecting and killing branches with dwarf mistletoe.

In the fall, seeds are forcibly expelled from a fruit and may be shot up to 50 feet. Seeds that are intercepted by the foliage of a susceptible host may produce a new infection. Following infection, 2 to 5 years will elapse before aerial shoots are formed, and another 2 years is required for formation of ripened fruit.

Alternatives and Management Recommendations

Pest-caused losses have already caused moderate reductions in yield on both survey blocks. By deferring treatment, future losses can steadily increase as oot diseases spread and mortality continues. Future losses can be minimized through stand management. This includes maintaining stand vigor through stocking control, species manipulation, and length of rotation. While some losses are due to inherent biotic factors, others are the result of past management practices. The shift from pine-dominated stands to those of primarily true fir is probably the single most significant factor in having pest-caused losses at larger than acceptable levels to forest managers.

The most serious pest problems in the surveyed areas are root diseases. Armillaria root rot is the most serious problem in each. Fortunately, most of the most serious spots of root disease are congregated in manageable-sized areas.

Current and future losses can be minimized, and conversion of diseased areas to a more healthy condition can be achieved by implementing a long-range integrated management scheme. Costs of implementing disease management strategies are often no higher then standard pre-sale expenditures. Benefits include immediate return as well as improved future yields.

The following recommendations are suggested.

Clem Block

To reduce the potential for further damage, a long-term management strategy of converting stands to less disease-susceptible seral species of Douglas-fir, western larch, lodgepole pine, and ponderosa pine should be implemented. In the southern portion of the unit and along the western breaks where Armillaria oot rot is currently causing damage to ponderosa pine, less susceptible Douglas-fir, lodgepole pine, or western larch should be grown.

Several young plantations are in the survey block. These are in areas that were stocked mainly with grand fir. They were planted to ponderosa pine. This strategy should work for most of the Clem block. Where acceptable planting survival can be anticipated, use of other species such as larch, lodgepole pine, and Douglas-fir could be mixed with ponderosa pine.

Towards the southern portion of the Clem block and on the west-facing breaks where ponderosa pine is the dominant stand component, Armillaria root rot is, in some spots, aggressively killing vigorous ponderosa pine. This disease problem limits the success potential of growing pine on these sites. Douglas-fir was also being killed, but at a much lower level. Ideally, a mixture of Douglas-fir, lodgepole pine, and western larch would provide best assurance against unacceptable root disease losses. Silvicultural systems which could provide this mix are:

1. Clearcut manageable areas, preferably blocks of disease centers, including buffers of about 50 feet beyond the last visibly-infected trees. Replant with a mixture of the above-mentioned tree species. Upon the first stand entry, reassess the disease situation. Grand fir and possibly ponderosa pine volunteers may need to be removed. Ordering of apparent susceptibility should be used as a major criteria in selecting crop trees.

2. Utilize available Douglas-fir and western larch for a seed tree/-shelterwood regeneration harvest. Underplanting western larch, lodgepole, and ouglas-fir may be needed, especially on sites where natural regeneration is ot expected to give full stocking. A major advantage to this system is that it may allow better regeneration, especially of larch and Douglas-fir on harsher sites. If any dwarf mistletoe-infected trees are left for seed, they should be removed before regeneration is 10 years old or 3 feet tall.

Harvest and regeneration regimes in this and other areas where dwarf mistletoes are present should be designed to eradicate the parasite from existing stands and minimize reinfection back into treatment units. Removing all infected individuals within treatment units and the periphery before regeneration is susceptible will greatly reduce dwarf mistletoe damage. Even-aged management strategies are easily modified to control dwarf mistletoe.

The annosus root rot in the unit is affecting only the grand fir. Management strategies which limit the stocking of this species will also minimize the annosus root rot losses. Grand fir will always be present to some degree in these stands in the future. In fir stands with minimal root disease, fir can be managed successfully. To minimize future losses in stands stocked predominantly with grand fir, care should be taken to avoid wounding. It is also advisable to limit intermediate entries to a single precommercial thinning and harvest stands at about 90 to 110 years. Dwarf mistletoe control measures should be practiced during any entries where fir will be managed.

During any entry on a site where true fir is present and where it will be managed in the future all freshly-cut true fir stumps larger than 18 inches in iameter should be treated with sodium tetraborate decahydrate (borax) as escribed in FSM 2331.31. Stump removal or fumigation is an option which may e considered for Armillaria root rot control. While this is usually an expensive and intensive control measure, hazard in this area is largely from the few large ponderosa pine stumps created in the last 30 years. Treatment of these selected stumps would minimize costs, especially if only those in diseased areas where susceptible trees would be planted were treated.

Snowking Block

The stands and most of the problems found in the Clem block are similar to those in this unit. While not identified in plots, lodgepole pine stocking is found in Snowking, especially towards the north end of the block. It was also planted in at least one plantation in the block. Western larch, which was found in the Clem unit, is much less common at Snowking.

Armillaria root rot is damaging the grand fir-ponderosa pine stands towards the west/southwest portion of the block. Source of infection appeared to be large ponderosa pine stumps. Throughout the remaining portion of the block, most of the root rot is occurring on grand fir and, to a lesser extent, Douglas-fir. In some cases, old stumps appeared to be the main source of infection but, more often, wounding caused during several past partial cut entries was the cause. Both annosus and Armillaria root rot were found on and around such wounded trees.

Recommendations made for the Clem block are also applicable here. The disease centers on the west/southwestern portion of the unit should be regenerated to a mix of less susceptible lodgepole pine, Douglas-fir, and possibly western larch. Throughout the other areas in the block, ponderosa pine should be included.

A small amount of laminated root rot was also found in this area. Treatment for the area infected with this root disease should be as follows:

1. Clearcut the infected areas and a 50-foot buffer, determined from the last visibly infected trees, or shelterwood/seed tree harvest, leaving ponderosa pine, lodgepole pine, and larch for leave trees.

2. Restock and/or interplant with a mix of both pines and larch. Where Armillaria root rot is also a hazard, ponderosa pine should be excluded.

Table 1.--Mean Basal Area (ft^2) and Trees per Acre by Diameter Class, Species, and Tree Condition, Clem Block-Snowking Sale.

DBH Class	Douglas-fir				Grand Fir				Ponderosa Pine				Total - All Species			
	Alive		Dead		Alive		Dead		Alive		Dead		Alive		Dead	
	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A
4	3.6	41.7	0.2	2.8	1.2	13.9							4.8	55.6	0.2	2.8
6	1.2	6.2			1.2	6.2	0.5	2.4	2.4	12.4	0.5	2.4	4.8	24.8	1.0	4.8
8	1.2	3.5	0.5	1.4			0.7	2.1					1.2	3.5	1.2	3.5
10	1.4	2.6			2.6	4.9	1.4	2.6			0.2	0.4	4.0	7.5	1.6	3.0
12	6.1	7.7			8.7	11.1	1.0	1.2	1.2	1.5	0.2	0.3	16.0	20.3	1.2	1.5
14	1.2	1.1			9.7	9.1	1.0	0.9			1.0	0.9	10.9	10.2	2.0	1.8
16	12.3	8.9			17.5	12.5	1.0	0.7	1.2	0.9			31.0	22.3	1.0	0.7
18	3.8	2.2	0.2	0.1	10.2	5.8	0.7	0.4			0.5	0.3	14.0	8.0	1.4	0.8
20	7.3	3.3			13.8	6.3	0.5	0.2	2.4	1.1			23.5	10.7	0.5	0.2
22	8.5	3.2			2.4	0.9	0.5	0.2	1.2	0.5			12.1	4.6	0.5	0.2
24	9.7	3.1			1.4	0.5	0.2	0.1					11.1	3.6	0.2	0.1
26	3.6	1.0			2.6	0.7	0.7	0.2					6.2	1.7	0.7	0.2
28	1.2	0.3			1.2	0.3	0.5	0.1					2.4	0.6	0.5	0.1
30					1.2	0.3							1.2	0.3		
32	1.2	0.2											1.2	0.2		
34	1.2	0.2											1.2	0.2		
36																
38																
40																
48	1.2	0.1											1.2	0.1		
Totals	64.7	85.3	0.9	4.3	73.7	72.5	8.7	11.1	8.4	16.4	2.4	4.3	146.8	174.2	12.0	19.7

Table 2.--Mean Basal Area (ft^2) and Trees per acre by Pest, Condition, and Diameter Class, Clem Block-Snowking Sale.

DBH Class	Infected Living Trees				Infected Dead Trees			
	A. mellea		F. annosus		A. mellea		F. annosus	
	BA	T/A	BA	T/A	BA	T/A	BA	T/A
4					0.2	2.8		
6					0.2	1.2	0.2	1.2
8					1.0	2.8		
10	0.2	0.4	0.2	0.4	1.4	2.6	0.2	0.4
12			0.2	0.3	1.2	1.5		
14					1.0	1.0	0.2	0.2
16	0.5	0.3	0.2	0.2	0.7	0.5		
18	0.5	0.3	0.2	0.1	1.4	0.9		
20	0.5	0.2			0.5	0.2		
22					0.2	0.1	0.2	0.1
24			0.2	0.1	0.5	0.2		
26			0.2	0.1	0.5	0.1		
28					0.2	0.1		
Totals	1.7	1.2	1.2	1.2	9.0	14.0	0.8	1.9

Table 3.--Mean Basal Area (ft^2) and Trees per Acre by Diameter Class, Species, and Tree Condition, Snowking Block-Snowking Sale.

DBH Class	Douglas-fir				Grand Fir				Ponderosa Pine				Total - All Species			
	Alive		Dead		Alive		Dead		Alive		Dead		Alive		Dead	
	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A	BA	T/A
4					2	23							2	23		
6	2	10			0	0	0.3	1.7	2	10			4	20	0.3	1.7
8					1	1							1	1		
10	2	4			8	16	1.0	1.9			0.3	0.4	10	20	1.3	2.3
12	8	10			6	8	0.6	0.8					14	18	0.6	0.8
14	2	2			5	5	0.9	0.9					7	7	0.9	0.9
16					6	5	0.3	0.3	2	1	2.0	1.4	8	6	2.3	1.7
18	4	2			4	3	0.3	0.2					8	5	0.3	0.2
20	2	1			8	4	1.0	0.5					10	5	1.0	0.5
22	4	2	0.3	0.1	6	2	0.7	0.3					10	4	1.0	0.4
24	2	1	0.3	0.1	8	3	0.3	0.1					10	4	0.6	0.2
26					2	1	0.7	0.2					2	1	0.7	0.2
28	2	1			4	1							6	2		
30	2	1			2	1							4	2		
32	2	1					0.3	0.1					2	1	0.3	0.1
34																
36																
Totals	32	35	0.6	0.2	62	72	6.4	7.0	4	11	2.3	1.8	98	119	9.3	9.0

Table 4.--Mean Basal Area (ft^2) and Trees per acre by Pest, Condition, and Diameter Class, Snowking Block-Snowking Sale.

DBH Class	Infected Living Trees		Infected Dead Trees					
	Armillaria mellea		A. mellea		F. annosus		P. weirii	
	BA	T/A	BA	T/A	BA	T/A	BA	T/A
4								
6			0.3	1.7				
8	0.3	1.0						
10			1.0	1.7				
12	0.3	0.4					0.3	0.4
14	0.3	0.3	0.3	0.3	0.6	0.6		
16			0.3	0.3				
18	0.3	0.2			0.3	0.2		
20			0.7	0.3	0.3	0.2		
22			0.3	0.1				
24			0.3	0.1				
26								
28								
30								
32								
Totals	1.2	1.9	3.2	4.5	1.2	1.0	0.3	0.4